PAVEMENT PROFILES : EFFECT OF PERMAFROST DEGRADATION

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Theme 2 - M.Sc. project

OBJECTIVE

To develop a profile analysis tool using longitudinal pavement surface profiles.

- Identify profile characteristics related to permafrost degradation
- Early identification of zones affected by specific deterioration mechanisms

METHODOLOGY

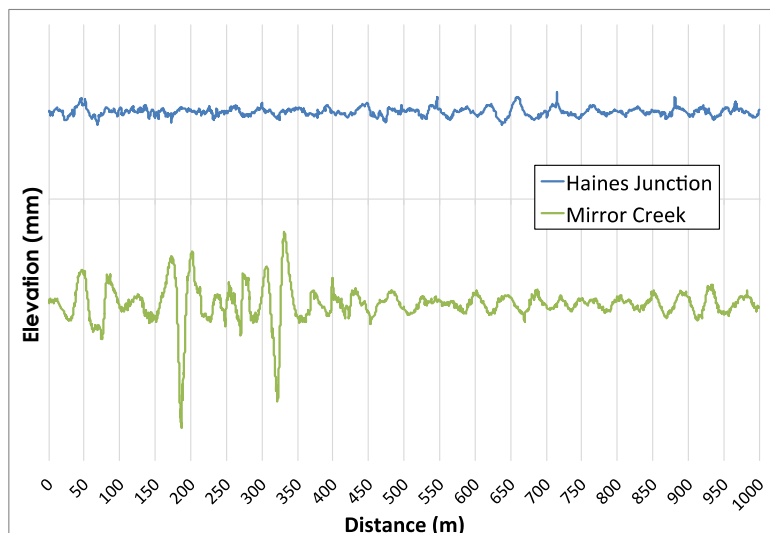3 test sites monitored on the Alaska Highway, Yukon

Measurements in April (maximum freeze) and September (maximum thaw)

Longitudinal profiles filtered between 0.7 m and 45 m, covering:
- short wavelengths (near-surface deterioration mechanisms)
- long wavelengths (deep degradation)

Surpro, low speed profilometer,
Alaska Highway, Yukon

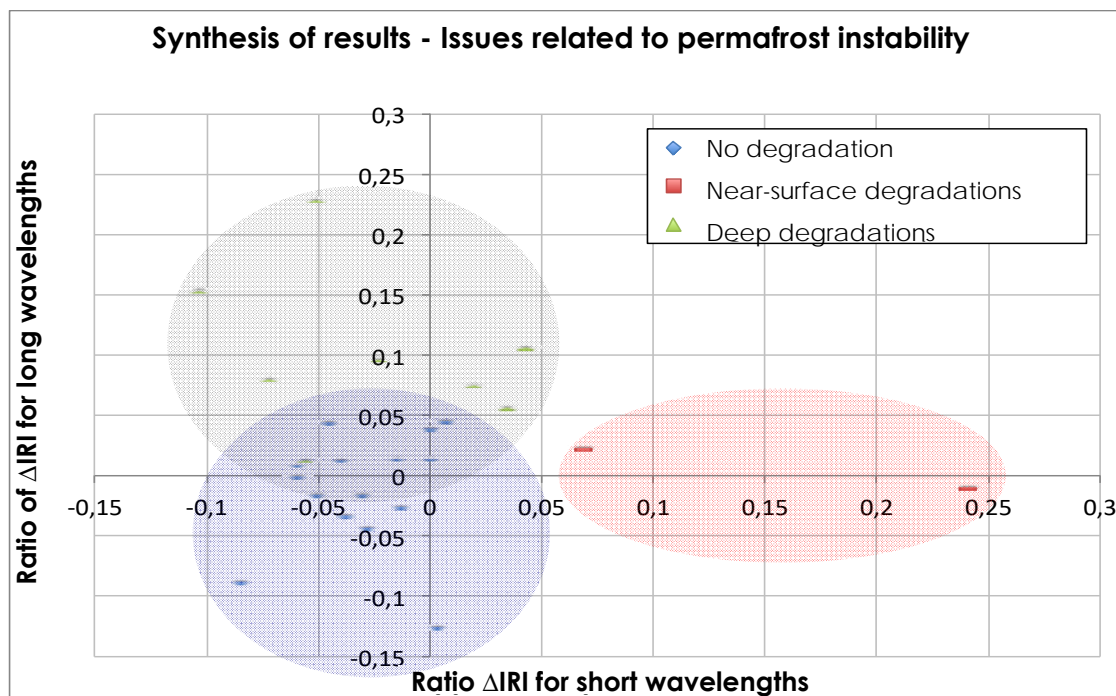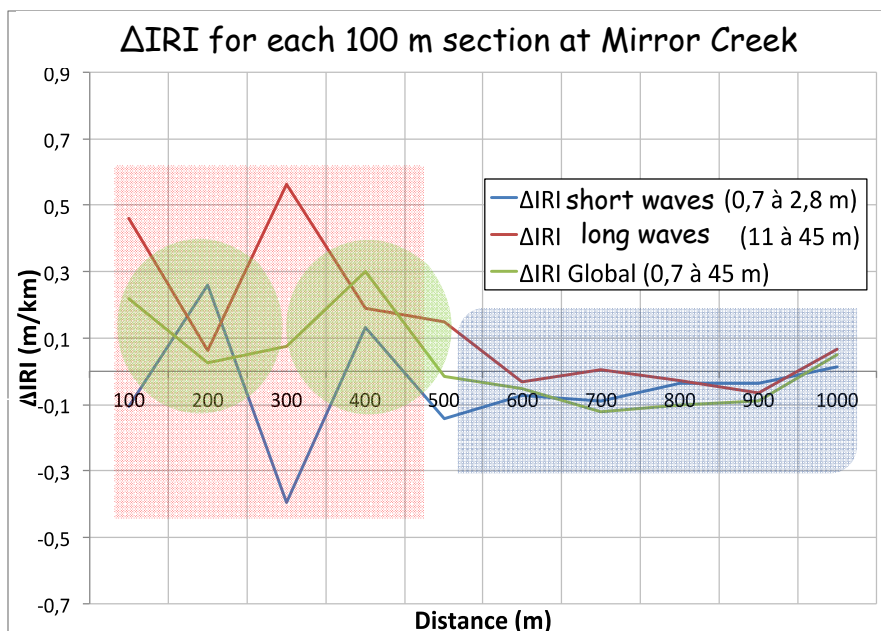Longitudinal profiles filtered between 0.7 m - 45 m

In permafrost contexts, the International Roughness Index (IRI) is higher in early fall due to thawing and uneven settlements.

$$\text{Ratio} = \frac{\Delta \text{IRI}_{(Fall - Spring)} \text{ filtered}}{\Delta \text{IRI}_{(Fall - Spring)} \text{ unfiltered}}$$

Fall : September (maximum thaw)
Spring : April (maximum freeze)

ΔIRI for each 100 m section at Mirror Creek

Legend:
- ΔIRI short waves (0,7 à 2,8 m)
- ΔIRI long waves (11 à 45 m)
- ΔIRI Global (0,7 à 45 m)

Y-axis: ΔIRI (m/km)
X-axis: Distance (m)

Synthesis of results - Issues related to permafrost instability

Legend:
- No degradation
- Near-surface degradations
- Deep degradations

Y-axis: Ratio of ΔIRI for long wavelengths
X-axis: Ratio ΔIRI for short wavelengths

*More study sites are required to develop a reliable tool

BENEFITS

- A methodology has been developed and trends were identified using pavement profiles as a tool to better identify thaw-sensitive permafrost under existing paved infrastructures.